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So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues is given for reference. Attention is directed especially to Volume VII which had only one part:—

Vol.			*Vol.*		
1.	3 numbers,	1928	8.	4 numbers,	1935–7
2.	4 ,,	1929	9.	4 ,,	1938
3.	3 ,,	1930	10.	4 ,,	1939
4.	4 ,,	1931	11.	4 ,,	1940
5.	2 ,,	1932	12.	4 ,,	1941
6.	2 ,,	1933	13.	4 ,,	1942
7.	1 number,	1934	14.	4 ,,	1943

ISSUES OF THE AGRICULTURAL CIRCULAR.

THE following were the numbers and year of issue of the *Agricultural Circular*:—

Vol. 1, 1920, 12 numbers.	Vol. 4, 1923, 1 number.
,, 2, 1921, 5 ,,	,, 5, 1924–5, 2 numbers.
,, 3, 1922, 4 ,,	

As number 4 of Vol. 3 was printed as "Volume 4" and number 1 of Vol. 4 as "Volume 5" it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, Part 1.

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3. Rhinoceros Beetle in Samoa, 1912.
4. The Banana in Fiji, 1912.
5. Scale Insect on Bananas, 1913.
6. Lemon Grass, 1913.
7. A Mission to Java for a Coleopterous Pest of Bananas, 1914.
8. Coconut Experiments, 1915.
9. Soils of Fiji—I., 1916.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
13. Sea Island Cotton, 1920.
14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
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—EDITOR.

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ERATA—Volume 14, No. 3, September 1943—

Page 71, paragraph 6, line 2, For " Senior Veterinary Officer " read " Government Veterinary Officer ".
Page 78 paragraph 3, line 7. Delete " again ".
Page 78, paragraph 3, line 8. For " Medical Corps " read " Naval Reserve ".
Page 79, paragraph 5, line 1. For " bulletin (2) " read " bulletin (3) ".
Page 88, European Vegetables, Spring Onions. For " 3d.–6d. per lb ". read " 3d.–6d. per bundle ".

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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 14.] DECEMBER 1943. [No. 4.

THIS issue completes another year and contains the third of a series on the work of the various Divisions of the Department, this time with the Entomological Division which started in earnest in 1909 with the appointment of Mr. F. P. Jepson who on transfer to Ceylon in 1919 was succeeded by Mr. H. W. Simmonds. The various insects and weeds brought under biological control are reviewed as well as the work carried out over a period of a quarter of a century. The article indicates that excellent work has been performed in the sphere of entomology that on *Levuana* being classical.

Padi plantings in Vanua Levu are discussed from data supplied by the Agricultural Officer North and his staff and show for the three provinces of the island there was an average increase of 23 per cent over the plantings last year. By far the most favourite variety is Motka which has about six times the acreage of Patna which again has twice the acreage of the Lautoka variety.

The article on guarantees of purchase of produce details the prices of rice, yams, dalo and sweet potatoes at their various centres. It is explained that the ruling market prices are usually half as high again as the guaranteed prices which are adequate to secure the grower against loss. The growing of rice and vegetables should not, however, interfere with normal production of sugar cane which is also a vital crop.

The sugar cane is the most important agricultural export crop grown in the Colony and as the report of the Sugar Commission has recently been published a short note on the report is included under Reviews in this issue and should prove of interest.

In support of the leper settlement at Makogai, of which the Colony is justly proud, readers are invited to assist in the growing of chaulmoogra trees, the fruits of which are required for the treatment of leprosy. The oil derived from the fruits has already proved effective in curing some fifty patients annually so that it is of immense utility in the control of this terrible disease and co-operation will be very welcome.

Bat guano as a fertilizer is of some importance as an export, some 300 tons being exported to New Zealand in 1942. A study of the guano insects, exclusive of the ants which form the bulk of the droppings, has been begun and most of the insects are described—one small moth has yet to be identified as the type collections from the British Museum (Natural History) have been evacuated from London into the country.

Further details about mosquitoes of the Suva area give life history data of the five commonest species and show that from egg to adult mosquito is rarely under twelve days. The breeding of the vexatious night-biting *Aedes vexans* is shown to occur in Suva and its suburbs. An attempt to find correlation between the volume of our so called static water tanks and the relative abundance of mosquito breeding was unsuccessful though it occurs in parts of England.

A review which indicates the value of grass conservation in agricultural practice in the tropics and its preservation from fire is of practical application in Fiji and merits attention.

A number of other interesting reviews are included in this issue. These deal with the fine work that has been done in Britain towards securing the home food front, the rehabilitation of European agriculture after the war and similar subjects which help us in this Colony to realize our good fortune, so far, in the world war.

Besides an interesting series of extracts is an illustration from a plastic block, the first time since June 1938 that a plate has appeared in the *Journal*.

ENTOMOLOGICAL SERVICES IN FIJI.

By

R. J. A. W. LEVER, B.Sc., D.I.C., A.I.C.T.A., F.L.S.

OFFICIAL entomological activities in Fiji were begun in 1906, when the then Superintendent of Agriculture, Mr. C. H. Knowles, B.Sc., published in his annual report a description of insect pests of cotton, cocoa, bananas and coconuts, which he had previously briefly referred to in 1905. His annual report for 1908 (1) dealt at greater length with coconut pests, especially the leaf-miner *Promecotheca reichei* Baly, and recommended the appointment of a full time entomologist. This post was duly filled in October 1909, Mr. F. P. Jepson, M.A., Dip. Agric., being selected, and within two years he brought out a Report on Economic Entomology (2) which is the basis for all publications on Fijian entomology.

The report dealt at some length with the inevitable difficulties of the creation of a new division. Jepson went so far as to say "I can hardly concieve of any country presenting much greater difficulties to an Entomologist than Fiji", which rather ignores the climate of, say, West Africa and the Solomons. Ants, mites and mould were the chief problems in maintaining a collection and mould was still a handicap in 1922.

Besides insect pests of economic crops, Jepson dealt with blood-sucking flies including the mosquito called *Culex jepsoni* Theobald, which was *C. sitiens* Wied., while the *C. jepsoni* referred to by Bahr (3) was really *C. annulirostris* Skuse. The opening of the Panama Canal in 1914 raised the threat of yellow fever gaining access to the Colony.

Although as far back as 1891 there was a Diseases of Plants Ordinance, it was not for another twenty years that quarantine regulations were seriously considered. Very wisely permission was obtained for Jepson to proceed to Honolulu to study the method of inspection of plants and fruit, and a very profitable month was spent there in October 1910. Besides returning with the Mexican seed-destroying fly *Agromyza lantanae* Frogg., Jepson brought back three genera of top minnows (*Mollienesia, Fundulus* and the well known *Gambusia affinis*) which were liberated at Nasinu.

Jepson's second official overseas visit was to Samoa in April and May 1912 " in order to study the habits and extent of the ravages of the rhinoceros beetle *Oryctes rhinoceros* Linn.", and an excellent account of his researches, with good photographs of damaged coconut palms, soon appeared after his return to Fiji.(4)

The banana weevil, *Cosmopolites sordidus* Chevr., being a source of trouble to banana planters, Jepson again left Fiji in 1912, this time to Java, where he collected 5,000 individuals of the predacious Histerid beetle *Plaesius javanus* Erich. of which 3,792 were transported alive in moist earth to Fiji. Jepson's bulletin,(5) on this project shews the difficulties attendant on looking after his charges, as biological control was then a novelty, although the sugar interests in 1913 imported a parasitic fly—*Microceromasia sphenophori* Villen. for control of the cane weevil *Rhabdocnemis obscura* Boisd.(5*a*)

During the next five years Jepson's reports dealt with a large variety of subjects such as scale insects, tea leaf-curlers, fruit- and seed-flies, *Levuana iridescens* B.-B., dalo hawk moth, Japanese rose beetle, scab moth and stick insects. The laboratory was removed in 1915 from the telephone exchange to the old printing office where there was an absence of dust but more light and space, both of which were lacking in the former site.

In 1918 the Superintendent (Mr. Knowles) carried on the work of the Entomologist during Jepson's leave prior to his transfer in 1919 to Ceylon from which colony he recently retired. An attempt was made to procure the services of Dr. F. W. Illingworth, Professor of Entomology, Honolulu College of Hawaii, but without success and the post of Government Entomologist was temporarily offered to Mr. H. W. Simmonds, F.R.E.S., who went off to Tahiti a few months after his appointment in 1920 to obtain parasites of the coconut scale *Aspidiotus destructor* Sign. Simmonds was confirmed in his appointment in 1925.

It is proper that one should record here that as recently as 1922 the laboratory was officially described as " very unsuited " for its work, the walls being damp and mouldy and it was not even possible completely to close it ! Under such conditions was entomology carried out only twenty years ago in the tropics. This was the third site for the insectary and office which were removed in that year from the old printing office to the old Government buildings.

In 1922 Simmonds' travels, which were eventually to take him to most of the islands of the Pacific, were to Wallis Island or Uea and Fotuna or Hoorn Island. This was followed in 1923 by what must have been his most interesting undertaking of all, viz. eight months on a mission to the New Hebrides,

Solomons, Bismarck Archipelago and New Guinea, chiefly to find possible parasites for *Levuana*. Although no trace was found of this moth, or any of its allies, the result of the trip was an excellent bulletin with coloured plates dealing with the pests and diseases of the coconut palm in the Southern Pacific.(6)

The coconut moth, *Levuana*, began in 1922 to spread from Viti Levu to Ovalau, Moturiki and other islands. This insect had been known in Fiji since 1877 and Knowles had brought out a bulletin in 1919(7) dealing with its life history and control, but it was not until 1925, when it seemed to threaten the coconut industry, that a campaign became justified and was organized by Dr. J. T. Tothill assisted by H. W. Simmonds, R. W. Paine and T. H. C. Taylor. Accordingly, Simmonds was dispatched to Malaya in 1925 with the object of collecting and preparing for export to Fiji, a colony of the Tachinid fly, *Ptychomyiar emota*, Ald. He succeeded in arranging for the shipment of a large colony on 85 coconut seedlings growing in seventeen large wire cages. Although only 315 parasites survived the journey to Suva in August 1925, it was from these that enough flies were bred to make *Levuana* a really scarce insect. The whole project was finally written up in great detail in a sumptuous book with thirty-four plates and one hundred and nineteen text figures.(8) It is no exaggeration to say that the parasitic fly saved the copra industry of the Colony and if this product later came to give a poor return to the planter this was not for entomological reasons.

In 1927 interest temporarily shifted from coconuts to cotton and reports for that year were chiefly devoted to cotton stainers (*Dysdercus* spp.), tip worm (*Earias fabia* Stoll.) and the pink boll worm (*Platyedra gossypiella* Saund). It is interesting to note that *Earias* was recorded from cotton bolls on Taveuni in 1873.(8*a*)

At this time cotton had assumed prominence as a crop, 919 bales of 350 lb each being produced in 1926. Development of a New Guinea kidney hybrid was pursued rather than the choicer Sea Island.

During 1927 and 1928 work was carried out on the spread of the banana borer, *Cosmopolites sordidus* Chevr., it being proved by Simmonds that infected suckers, rather than the flight of the weevil, was responsible for its increase. In July 1927 the third removal of the entomological buildings was made to its present site near the wharf, a site convenient for inspecting ships.

After the spectacular success with the control of *Levuana*, Taylor went to Trinidad in 1927 to investigate predators of the coconut scale *Aspidiotus destructor* Sign., success was again achieved, the insects being a series of ladybirds of which *Cryptognatha nodiceps* Mshsl. was outstanding. Taylor's work on this campaign ran to a complete issue of the *Bulletin of Entomological Research*(9) and described in detail the life histories of the beetles and their liberation in 1928 throughout the islands of the Colony. It is interesting to note that this scale was a pest of bananas when first noticed in 1912 and apparently did not attack coconuts till 1916.

In this same year, 1928, another project was under way—the control, not of an insect pest but of a noxious weed, viz. *Lantana aculeata* L., formerly referred to as *L. camara* L. The former name is preferred by Greenwood(16) who, however, does not give the most important insect enemy. Although, as already mentioned, Jepson in 1910 had introduced the seed-eating fly *Agromyza lantanae* Frogg. and the flower-eating butterfly *Thecla agra* Hew. also came in from Hawaii in 1923, there was still room for a foliage-sucking

insect and this was supplied by the bug *Teleonemia scrupulosa* Stal., locally referred to as *T. lantanae* Dist. until the writer drew attention(17) to the priority of the former name. This insect which Simmonds brought from Honolulu, causes a certain check to the plant in the dry zones of Fiji and has taken well to conditions in northern Queensland, but not in the southern and central portions of this State which are too cold and dry.(17*a*)

The next project was also the control of another noxious weed, this time Köster's curse, *Clidemia hirta* Don. which had been regarded seriously as long ago as 1906 and Jepson's report for 1918 shewed that the average number of seeds in the intestines of mynahs was 2,347·3 per bird.(10) In 1929 Simmonds was in Trinidad, British West Indies, continuing the work of Taylor who had shewn in 1927 that the insect *Liothrips urichi* Karny was keeping the weed under control. The writer was fortunate enough to see Simmonds' work on the breeding and despatch of the delicate thrips using the biological laboratory of the Imperial College of Tropical Agriculture as his base. The account of this work appears in detail in the *Bulletin of Entomological Research.*(11) The dense stands of this weed which almost stopped grazing in parts of Tailevu were soon things of the past; the saving in weeding alone was valuable and greatly helped the dairying industry.

In Fiji, Taylor was engaged on the study of the insects causing immature nutfall of coconuts and his results published in 1930(12) shewed that 8.80 per cent of this nutfall was due to the caterpillars of the spike moth, *Tirathaba trichogramma* Meyr. As a result Paine made two trips to Java and returned to liberate several parasites, of which *Apanteles tirathabae* Wilk., *Telenomus tirathabae* Ferr. and the Tachinid fly *Erycia basifulva* Bezzi, were the chief. As shewn in Paine's bulletin(13) the fall in the price of copra from £14 to about £6 per ton made it impossible to recover the expenses of the campaign but the control exercised by the joint action of the parasites certainly checked the caterpillar and it has been continued ever since.

During this same year (1935) Paine brought out his excellent bulletin,(14) unfortunately published without a serial number, on the mosquitoes of Fiji, which, although called an introduction, deals in considerable detail with all the known species, Paine himself being responsible for finding those new species (*Culex albinervis* Edw. *Uranotaenia colocasiae* Edw. and *U. painei* Edw.) one new variety (*Aëdes scutellaris* Wlk. *horrescens* Edw.) and in 1931 introducing two predatorial species *Megarhinus splendens* Wied. and *M. inoratus* Wlk. The latter piece of work was done for the control of the filarial-spreading mosquito *Aëdes scutellaris pseudoscutellaris* Theob. and was duly described in detail.(15) Paine's mosquito paper became so popular that the writer was instructed to prepare a second edition, which was printed early this year.

An interesting point is that practically all the harmful insects which, as has been shown, were one by one being controlled, had all been known as pests for many years, *Levuana* since 1877, *Cosmopolites*, recorded as harmful in 1906, *Aspidiotus* since 1912, *Tirathaba* (then called *Harpagoneura*) also since 1906. The next remaining pest was no exception, this being the leaf-mining beetle *Promecotheca reichei* Baly,—already shown to have attracted Knowles' attention in his first report—and featuring largely in Jepson's reports up to his final one in 1918. Paine had already done some work on its parasites in Java in 1930, but it was Taylor's introduction of *Pleurotropis parvulus* Ferr. from that island into Fiji in 1933 which was instrumental in controlling the leaf-miner. Although in 1906 said to be doing " not great " damage, yet in 1913 it was described as " certainly

severe ". It is interesting to record that Java and Trinidad have been the islands from which most of our beneficial parasites and predators have come while Oahu, Hawaii, holds a unique place in being the source of supply of many non-Pacific parasites which the entomologists, both official and of the Hawaiian Sugar Planters' Association, have kindly forwarded. Taylor's work was published in 1937 by the Imperial Institute of Entomology[18] and earned him a Doctorate of the University of London. Shortly after his return from Java Taylor left Fiji prior to his transfer to Uganda in 1934, where he changed from work on insect pests of coconut to those of cotton. Paine similarly left the Colony in that year, taking up residence in Argyllshire. The work of these two entomologists during their nine years' united service it would be difficult to assess monetarily, but the value to the Colony was high.

Work during the next year was concentrated on fruit-flies, Simmonds turning out an excellent bulletin[19] on *Chaetodacus passiflorae* Frogg. and *C. xanthodes* Brown, with illustrations by the entomologist and his laboratory assistant, Miss Viwa McHugh, who kept stocks of parasites going during the entomologist's frequent absences (both from Suva and the Colony) and put in seven years' very valuable Government service. The parasite *Tetrastichus giffardianus* Silv. was introduced from Honolulu in 1935 and 100,000 individuals liberated within twelve months.

The year 1936 was chiefly notable for the introduction from Honolulu of the South American toad, *Bufo marinus* L. and various overseas shipments of insects. In July 1937 the writer was appointed Government Entomologist. Routine liberations of parasites, both in the Colony and abroad, were continued, *Plaesius* being sent to Tahiti, Jamaica and the Cook Islands, and next year *Pleurotropis* was sent to New Guinea and Tonga, and *Melittobia* (formerly *Synotomosphyrum*) was imported through the good offices of the Government Entomologist, New South Wales.

Although Simmonds, now an Officer of the British Empire in recognition of his valuable service to the Colony, had retired in 1937, he was invited to proceed on a final entomological mission two years later, and a visit was paid to Malaya, Java, Mauritius, Madagascar and Zanzibar in 1939. The purpose was to obtain Scoliid wasp parasites to control the rhinoceros beetle in Western Samoa, the presence of this pest causing in Fiji shipping delays due to quarantine measures for ships arriving from Samoa. Some 210 wasp parasites [20] were released and although none have been recovered or seen in the field during the intervening four years it is too early to say they have not become established. Of more interest to Fiji was the introduction by Simmonds of the dung beetle *Platylister chinensis* Quensel to check breeding of house-flies in cattle manure and 1,000 of these useful beetles have been liberated in various areas during 1943.

It is hoped that the foregoing description of the activities of the Entomological Division will be of some interest and as published accounts of the earlier days are both few and scattered the details should be recorded in one place. The work done on the biological control of *Levuana*, coconut scale, spike-borer, leaf-miner and Köster's Curse, will be found to stand comparison with any other Colony, though the natural advantages of Fiji as an isolated and small group of tropical islands with a constant warm temperature and relatively restricted number of indigenous parasites and predators, help to make ideal conditions for successful biological control.

The work since the outbreak of hostilities has not been dealt with but it was handicapped by such circumstances as temporary cessation during periods of military training and duties, extra non-entomological civilian work, necessity for remaining in Suva with consequent inability for inter-island travel and inevitable restriction on motor car tours. There was an increase in insecticidal control of vegetable garden pests coupled with the usual wartime difficulty of getting the required insecticides at the required time and here the United States forces were very helpful.

Mention also must be made of the valuable assistance rendered to the Entomologists by past and present Fijian assistants, Jonah, Elijah, Jacob and Philip, since without their excellent co-operation and interest in their work the senior staff would have been greatly handicapped in their work. Philip, in particular, has proved himself an able, reliable and indefatigable worker over a period of eleven years and deserves much credit.

Finally, one must mention the Imperial Institute of Entomology (founded in 1913 as the Imperial Bureau of Entomology), which regularly forwards identifications of specimens; without such a service insects have to be referred to clumsily as parasite A, Braconid C and Chalcid Z, etc. Despite unrestricted submarine warfare and the blitz in London, which damaged the Institute buildings in 1940, specimens still arrive after their long double journey from and to Fiji.

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AGRICULTURAL AND COPRA NOTES.

1. PADI PLANTINGS IN VANUA LEVU.

THE following notes have been abstracted from a comprehensive report on 1941/42 and 1942/43 padi plantings in Vanua Levu compiled by Mr. M. D. ffrench-Mullen, Agricultural Officer Northern Division and his staff. It should be noted reference is made throughout only to padi planted by non-cane growers.

The total acreage planted to padi in the 1942/43 season amounted to 3,631 acres compared with 2,940 acres in 1941/42, an increase of 23 per cent. The province of Macuata contributed largely to this increase as is shown in the following table:—

PADI ACREAGES BY PROVINCES.

Province.	1941/42.	1942/43.	*Increase.*	*Percentage increase.*
Macuata	1,864	2,346	482	26
Bua	772	900	128	16
Cakaudrove ..	304	385	81	27
Total ..	2,940	3,631	691	average 23

It was estimated that in the 1942/43 season approximately 130 acres of padi were damaged by leaf yellows disease, caused by the rice leaf-hopper (see this Journal Vol. 13, June 1942, No. 2, p. 49) with partial or total loss of crop, bringing the effective acreage down to 3,501. This compares with only 20 acres estimated to have been wholly or partly lost in 1941/42.

In Macuata Province the district of Dreketi accounted for 34 per cent of the 1942/43 acreage with Sasa, Nadogo, Macuata, Labasa, and Wailevu districts next in order. Seaqaqa district is shown as producing rice for the first time in 1942/43 following the opening up of a new settlement. The greatest actual and proportionate increase in acreage over 1941/42 was in the district of Macuata, with large increases also in Dreketi, Sasa and Labasa. There was a decrease in recorded acreage in Wailevu owing to flood damage early in the season.

In Bua Province the district of Lekutu is the largest producer with 61 per cent of the total 1942/43 acreage for the Province. Bua district is next with 23 per cent, the remaining five districts making up only 16 per cent. The greatest increase in planting over the past season took place in Lekutu.

In Cakaudrove 39 per cent of the acreage planted was in the Wailevu East district with fair acreages also in Vaturova, Cakaudrove, Navatu

and Savusavu. There were increased plantings in Cakaudrove, Navatu, Vaturova and Wailevu East while in Saqani and Savusavu there were considerable decreases.

There were 961 Indian growers throughout the three Provinces with a total planting of 3,554 acres, and 39 Fijian growers with 76 acres. Indian growers therefore averaged $3\frac{3}{4}$ acres and Fijians nearly 2 acres to a holding. The acreage planted by Indians increased 24 per cent in 1942/43 over the previous season; Fijian plantings decreased by 13 per cent, though the number of Fijians planting rice decreased by only one individual. The number of Indian growers increased in 1942/43 from 754 in 1941/42 to 961.

The average area of padi planted per holding by Indian farmers in 1942/43 was 3 acres in Cakaudrove, $3\frac{1}{2}$ acres in Macuata and nearly 5 acres in Bua. In Cakaudrove the number of estate workers planting small areas of padi brings down the average acreage, while in Bua there are few estates and padi is the principal cash crop. In Macuata also there are few estates (other than cane) but farmers find a market for other crops in addition to padi.

The relative importance in the 1942/43 season of the principal varieties of padi is shown in the following table:—

PADI VARIETIES.

Variety.	1941/42 *season.*	1942/43 *season.*
Motka	2,013 acres	2,590 acres.
Patna..	425 ,,	492 ,,
Lautoka	233 ,,	242 ,,
Karia	150 ,,	95 ,
China Patna..	18 ,,	55 ,,
B. G. 75	57 ,,	101 ,,
Sonacalif	40 ,,	44 ,,
Other	4 ,,	12 ,,
Total ..	2,940 acres	3,631 acres.

Note.—In the issue of this Journal for September, 1943, (Vol. 14, No. 3, p. 86) particulars of padi plantings by cane growers were published by courtesy of the Colonial Sugar Refining Co., Ltd. The acreage of padi for the Labasa Mill area was shown as 1,231 acres, therefore the grand total of padi planted in Vanua Levu during the 1942/43 season was 4,862 acres. Particulars of varieties of padi planted by cane growers and of distribution by districts are not available. —C.H.

2. GUARANTEES OF PURCHASE OF PRODUCE.

LATE in 1941 Government decided to guarantee the purchase of certain types of vegetables with a view to the stimulation of production to meet rapidly expanding military requirements for fresh foodstuffs and at the same time to maintain supplies to civil consumers. As military orders are given at very short notice and are liable to fluctuate, and as any great contraction in orders would not be known in advance by producers, it was realized that some form of guarantee was necessary as military requirements were greatly in excess of what the civil market could absorb. These guarantees are still in operation, though prices have been raised from time to time.

In December 1941 the following guarantees were offered:—

Dalo .. £5 0s. 0d. a ton delivered at Suva, Nausori, Korovou or Sigatoka.
Kumalas £4 10s. 0d. ,, ,,
Yams .. £8 at Suva, £7 at Nausori, Korovou and Sigatoka.

These were "open" guarantees in the sense that there was no limit as to quantity.

In August 1942 guarantees were also approved in respect of certain classes of European vegetables and annual fruits. No open guarantees for such produce can be given but they operate as follows:—

Cultivators within reasonable distance of collecting centres (Nausori) Korovou (Tailevu), Dobuilevu, Ba, Namaka and Sigatoka, get into touch with the Agricultural Officer who gives them individual quotas with guarantees of purchase. This has been and remains necessary in order to relate possible total production to estimated demand and also to ensure that produce is not grown at any point from which it would be impracticable to collect. Guarantees for vegetables are offered at two-thirds of the Army contract price. Such guarantees are liable to amendment at any time, according to increasing or decreasing demand, but are good for three months from the date of the guarantee. Most of these vegetables are short term crops. In actual practice, in the case of most vegetables for which guarantees have been offered, demand has continued to be greater than the supply, and it has not been necessary to limit producers to definite quotas.

In September, 1942, guaranteed prices for yams, dalo and kumalas were raised to £9, £6, and £6 respectively at Suva, Nausori and Sigatoka. At other roadside points in Viti Levu the above prices less freight would be payable.

Guarantees have also been issued for the purchase of maize at £1 per four-bushel bag, naked, at Dobuilevu, Ra, and Labasa, but only in respect of contracts with individual growers.

The Supply Board has now authorized a guarantee of purchase of pad at £15 a ton, delivered in bags to any mill in Viti Levu. This guarantee wil be effective until December 31st, 1944.

It should be understood that the above are in no sense fixed prices. In most cases ruling market prices are half as high again as the guaranteed prices. Growers are free to sell where they like and at what price they can get, subject only to the published legal maximum price where such has been imposed. The guaranteed price is merely to secure the grower against loss by reason of sudden contraction in demand.

ENTOMOLOGICAL NOTES.

By
R. J. A. W. LEVER, B.Sc., D.I.C., A.I.C.T.A., F.L.S.,
Entomologist.

1. SOME COMMON MOSQUITOES OF THE SUVA AREA.

ARTICLES in this journal for March and June(1) gave the usual egg-laying sites of the half-dozen common mosquitoes of the Suva peninsula. Since then other records have been obtained and the area extended in the west to include Lami. Larvae of the night-biting *Culex fatigans* Wied. were found in September and October in rot holes in ivi trees (*Inocarpus edulis*), an unusual site and one not recorded among the thirteen water-places given by Paine(2), who also did not list soapstone or earthen drains, which are now commonly selected sites owing to the increased draining scheme and air raid shelters built in Suva.

Some records of life histories are given for the months of September and October 1943, having mean temperatures, respectively, of 74·7°F and 76·0°F. Figures are to nearest whole day:—

Aedes aegypti L.	2 egg,	11 larva,	2 pupa,	total 15
A. pseudoscutellaris Theo. ..	2 ,,	8 ,,	2 ,,	,, 12
C. annulirostris Skuse ..	2 ,,	8 ,,	2 ,,	,, 12
C. sitiens Wied.	2 ,,	10 ,,	4 ,,	,, 16
C. fatigans Wied.	2 ,,	13 ,,	2 ,,	,, 17

The well-named *Aedes vexans* Meig. continues to show marked periodic abundance and it is interesting to refer to severe outbreaks reported(3) for two or three nights only in October and December 1934, as the search by the entomologist in November of that year failed to find the breeding places. Although Nasese, Nasova, Muanivatu and Vatuwaqa are now the main breeding places, it is quite incorrect to say, as one frequently hears at the moment, that this mosquito does not breed in Suva proper, as larvae have been taken from hoofmarks, drains and trenches at Naiqaqi, Walu Bay, Toorak and Tamavua. It may here be mentioned that when Dr. (now Sir Philip Manson–) Bahr was living in Suva in 1910, he recorded it, under the name of *C. nocturnus*, as breeding in stagnant water round his house,(4) which is Na se ni bitu, Tamavua, the property of Sir Maynard Hedstrom. For this information I am indebted to Dr. W. M. Ramsay. The exact location of collecting areas is not always as straightforward as it might seem though it is clearly of great importance. Thus an official map of Viti Levu published in March 1939 marks Suva Point as the southern tip of the peninsula but for many years past only a pedant would use Suva Point to denote any place but Muanivatu.

Another interesting thing about *A. vexans* is that it is the only mosquito found both in the United Kingdom and Fiji, and a recent paper(5) shows it to be relatively rare in the former country, with a localized distribution; filling or draining of its favourite breeding places, in ponds or flooded meadows, is recommended, and this applies also to Fiji.

A worker in the Portsmouth area has recently shown(6) that static water tanks of 5,000 to 10,000 gallons capacity—the smallest used—provided half the total cases of mosquito breeding, while in tanks of a greater capacity than 10,000 gallons mosquito larvae and pupae were either absent or few and far between. An unsuccessful attempt was made to see if any similar correlation could be found between abundance of mosquito larvae and the

volume of so-called static water in the Suva area. However, *C. fatigans* or *C. annulirostris* were found in some receptacles of 30,000 to 40,000 gallons, while larvae were absent both in other 30,000 gallons stores and in one of 3,000 gallons. Various factors operate to account for this, chiefly that the local water is not strictly static, being gently flowing from dammed streams. The presence or absence of fish and amount of weed and refuse are additional complicating factors.

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2. INSECTS FROM CAVE DEPOSITS OF BAT GUANO.

On the floor of certain caves in Viti Levu, there occur fine, blackish-brown deposits of bat guano, in texture somewhat like coarsely ground coffee, and with a musty smell. Superficial examination shews them to be largely composed of remains of ants, with wing-cases of various bettles, these being the food of the bats. From one cave over 300 tons of this bat guano were exported in 1942 to New Zealand as fertilizer, so it seems of interest to deal with the insects found associated with the guano on the cave floors, where the insects have, of course, no present association with the bats which deposited it from above.

From a cave at Kalabo a small, oval, smooth, black beetle was taken in 1941, which has recently been determined by the Imperial Institute of Entomology as *Euxestus parki* Woll.; it has since been taken on bracket fungi growing on logs. This beetle is apparently replaced at the Tamavua cave by the cosmopolitan *Paromalus* (*Carcinops*) *quattuordecemstriata* (Steph.) which, besides being found elsewhere in grain and flour, is known (1) to be predacious on dung and small carcases. This beetle is also black but, as the specific name shews, has seven ridges on each of the elytra, or wing-cases. Another insect which has been reared from the Kalabo cave is a small, brown moth, *Monopis strichomela* Low, whose larva has a portable case or jacket as in the common clothes worm; Forbes (2) has recorded *M. crocicapitella* Clemens from a cave also in association with bats, this being in New York State. The genus *Monopis* seems, therefore, to have world-wide habits as a refuse feeder on bat guano.

Two flies have also been recorded from Tamavua, the larger is *Milichia angustifrons* Bezzi and the small *Desmometopa ciliata* Hend. The former has an interesting habit of settling on one's face despite tobacco smoke: a colleague of the writer complained of this persistent habit, which is also practised by *D. singaporensis* Kert. in Fiji, though this last fly has not been recorded from bat guano.

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SUPPLIES OF CHAULMOOGRA SEEDS FOR PLANTING.

THE following note has been received from Dr. C. J. Austin, O.B.E., M.B., Ch.B., the Medical Superintendent, Makogai. It is thought that there are many planters who would be glad to assist in this great work of healing by planting up half a dozen or so Hydnocarpus trees and delivering the fruit to a local collecting centre for despatch to Makogai.

"Chaulmoogra oil is now fairly well known as the basis of the modern treatment of leprosy and with its aid we are enabled to discharge an average of about fifty patients a year from Makogai. The oil (or its products) is injected regularly and the results of these injections appear to be influenced by the degree of freshness of the oil.

With the latter finding in view, it was decided some years ago to try to produce the oil locally and we have now several hundreds of Hydnocarpus trees in fairly flourishing condition. As a result we are now able to produce at Makogai about half our annual requirements of the oil. This oil is much preferred by the patients to the commercial imported product and appears to have much less irritant properties. Unfortunately we have reached the limit of land available for planting, and it has been suggested that coconut and other planters, as well perhaps, as Fijians or others would be willing to assist us and our patients by planting a few trees. In view of the above comments as to the superiority of the local product, it need hardly be emphasized that such assistance would be very warmly welcomed both by Government and by our unfortunate patients.

The trees—which grow to a height of 20 to 30 feet—should be planted at least 15 feet apart. Some of our trees have started fruiting after three years and almost all are bearing well after five years. The fruit should be collected as it falls and not allowed to rot on the ground. Arrangements for transport will need to be made as supplies become available, for the fresher the fruit when crushed, the better will be the oil produced.

The Director of Agriculture has kindly agreed to supply seeds for planting, and will be pleased to give further information to anyone interested."

Any planters or others who wish for seed should apply to the Director of Agriculture, Suva, the Agricultural Officer, Sigatoka, or the Agricultural Officer, Naduruloulou.

EXTRACTS.

1. POSSIBLE ENTOMOLOGICAL WARFARE.

A reason for encouraging more training along entomological lines is the real threat of entomological and biological warfare; that is, the intentional spread by our enemies of destructive insect vectors of human and animal diseases or direct pests of crops and store products. Since the Japs have already attempted to start epidemics of bubonic plague in China, it is obvious that we should provide men well trained in medical and veterinary entomology and insect control to check any such outbreaks that may be started by our enemies. The possibilities of entomological warfare are extremely potent. By distributing crop pests not now present in any territory upon growing crops; by showering pests of stored products over food depots and cities; and by the purposeful spreading of living insect-carriers of highly-fatal human diseases, crops could be ruined, stored products devastated, and human lives endangered to a greater extent than by direct human attack.

—C. L. Metcalf in *Journ. Econ. Entom.*, Vol. 36, No. 3, 1943.

2. DERRIS AND QUININE TO-DAY.

THE white crystalline compound obtained chiefly from the roots of the derris plant is one of the most valuable insecticides known to man. Its remarkable quality is this: it kills all insects and other "cold-bloods" but is harmless to men, livestock, and other "warm-bloods". It is a native growth in tropical America, where it used to be called "fish poison" because the natives found they could drop it into a pool, poison the fish, and then eat the fish with no ill effects.

To-day it is needed by us in substantial quantities, not only on the farms, but also in the armed forces. I am informed that Army and Navy requirements for 1943 are estimated at millions of pounds of processed rotenone powder. It is an effective agent for protecting our men against lice, mites and skin parasites.

In the years before the war, Malaya and the other Far Eastern tropics went in for rotenone production in a large way. At the time of Pearl Harbor they were producing more than three-quarters of the world's supply.

But the countries of Latin America were not caught entirely napping on this, either. They had a start, and when the Far Eastern supply was cut off they rapidly expanded their production. Here again the U. S. Department of Agriculture has been of outstanding help, for from the latter's tropical experiment station in Puerto Rico, planting stock of derris has gone to Haiti, Mexico, Honduras, Guatemala, the Dominican Republic, Ecuador, and other areas of the American tropics. The rotenone plants thrive in American tropical soils. They do not represent a huge industry, but within the limits of demands, which are steadily increasing, they are a good family crop for the citizen farmer.

The story of quinine is somewhat similar to that of rubber. It was originally discovered in Latin America growing wild. It was carried to the Far East, domesticated there, and the world market was dominated from Java. Then the Japs grabbed it. Now we, and our allies and the people of Latin America themselves, are short of quinine. Like rubber, it is being partially replaced by synthetic substitutes. But we still need natural quinine from the bark of the cinchona tree for many years to come in order to fight the menace of malaria.

The story is a similar one for dozens of other tropical crops which we have been bringing around the world. The essential oils of citronella and lemon grass; castor beans; vanilla beans, native to Mexico but later carried away to far-off Madagascar; teakwood, used for ship-decking; balsa, the lightest of strongwoods, used in making gliders for the Air Force and in the famous British "Mosquito" bombers; tropical tung oils and palm oils; cork oak; and all the many kinds of spices needed for flavoring and preserving foods.

Every one of these can be grown by the farmers of tropical America; every one has been grown in small or large quantities. Every one of them is needed by the United States, in war and in peace. Every one of them, raised in Latin America and sold to the United States, will make our southern neighbor republics stronger, more prosperous, more stable, and a better market for our own manufactured products. Incidentally, these tropical crops do not compete with the temperate climate crops grown in the United States.

——Zemurray, S. *The American Magazine.* October, 1943, p. 140

3. NEW WEAPONS AGAINST INSECTS.

A WARTIME development of an aerosol or fine-fog method of dividing and spreading insecticides, that is disastrous to certain insects—especially mosquitoes, flies, and many other household and greenhouse pests—was announced recently by the U.S. Department of Agriculture.

The method is far more effective, convenient, and economical than the old-time spray, and promises improvements and wider use. Preliminary announcements of this work were made in 1941 by chemists and entomologists of the U.S. Agricultural Research Administration. The discovery includes principally an insecticide material with an activator that makes the mixture work better, dissolved in a highly volatile solvent which propels and atomizes the insecticide into a fog, all in a container which keeps the mixture under high pressure ready for instant release. The solvent evaporates almost instantly, leaving the infinitesimal particles of the insecticide suspended in the air as an aerosol. More than a million containers or "bombs" of improved design, filled with the mixture, are on their way or already in use on the fighting fronts of Africa, the north Pacific and elsewhere to protect men of the United Nations armed forces against the irritations and dangers of mosquitoes, flies, and other insects.

Its development is primarily the result of an idea originated by Dr. Lyle D. Goodhue of the Division of Insecticide Investigations of the U.S. Bureau of Entomology and Plant Quarantine, at Beltsville, Maryland. In his words, "It is a lot of insecticide in a small space, carrying its own distributive power, non-toxic to man and beast, yet highly toxic to many species of insects." This fine suspension is non-inflammable.

Regardless of the insecticide used, which depends upon the pest to be killed, the method consists essentially in mixing the killing agent with a liquified gas, dichlorodifluoromethane, the complete mixture going into a strong steel container for release in small "puffs" when needed. With pyrethrum, sesame oil is used as a synergist—it doesn't take part in the actual job of killing insects but makes the pyrethrum more effective for that purpose.

Nicotine aerosol tests against aphids on greenhouse vegetable crops show the pests can be controlled with about one-half as much nicotine as when nicotine powder is burned as a control measure. With aerosol, all that is necessary is to walk through the greenhouse releasing a puff from the "bomb" at predetermined intervals and go out the other end and close the door.

The cyclamen mite, which attacks 50 to 60 greenhouse crops and a number of field crops, including strawberries, has been controlled well indoors with test applications of lauryl thiocyanate in aerosol form. In a practical green house experiment on snapdragons, two aerosol treatments completely cleaned up the mite with no plant injury whatever.

The aerosol mixture cannot be made up by the individual users as the solvent is so volatile it must be put in the containers while under pressure. In commenting on recent aspects of the aerosol research, Dr. P. N. Annand, chief of the Bureau, said, "These new developments have not only been just what was needed by the military forces, for control of disease-carrying insects, but they give promise of providing a better control weapon for use all along the front of man's never-ending war against insects . . ."

—Office of War Information, Washington, D.C.

4. MALARIA CONTROL IN GUADALCANAL.

ANTIMALARIAL measures which have recently been adopted by the United States authorities in the South Pacific have reduced the malaria rate among their troops from 212 to 21 per 1,000 men, it is officially stated. The troops are issued with a skin lotion called indalone, which gives protection against mosquito bites for three or four hours after application. A liquid known as freon, commonly used in mechanical refrigerators, is used to spray dug-outs and tents; and on Guadalcanal a battery of anti-mosquito oil-spraying guns mounted on jeeps is in action, every pool within the area under military control being sprayed once a week. —*Crown Colonist*, August 1943.

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5. OINTMENT, ANTI-MOSQUITO.

It is reported that Australian scientists have developed a new repellent mosquitoes in the form of an ointment which is superior to anything hitherto used in that it remains effective for at least 12 hours after application—sufficient for the longest tropical night. Medical and military authorities are said to be most enthusiastic about the new preparation, which, if it is as effective as claimed in preventing attacks by the malaria-carrying *Anopheles* mosquito, will reduce sickness casualties among troops in tropical areas by at least 50 per cent. —*Crown Colonist*, April 1943.

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6. WAR TIME ECONOMY IN BRITAIN.

In Britain a single person earning £500 per annum now pays over £150 of it away in income tax; if he earns £1,000 he pays over £380.

Twenty cigarettes now cost 2s. in Britain; nearly three-quarters of the price (1s. 5d.) goes to the Exchequer in duty.

There is now no white bread in Britain; there is an abundance of wholemeal bread which is not rationed; there are no bananas, no lemons and only a few oranges for children.

The adult people of Britain are on small rations of meat, milk, eggs, butter, margarine, fats, bacon, ham, sugar, tea, preserves, sweets and chocolate.

The ordinary man who cannot show urgent necessity for using his car is not allowed any petrol at all.

To a great extent the non-food retail trades in Britain have already lost half their whole labour force.

Britain's present production of saucepans and kettles enables every household in the country, on an average, to buy only one new kettle and one new saucepan every four years.

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Over £469 million was raised for the war savings campaign in War Weapon Weeks held between September, 1940 and June, 1941. This is an approximate average of £10 per head of the British population.

Over £545½ million more was raised during Warship Weeks in the United Kingdom between October, 1941, and March, 1942. The amount thus raised in England and Wales alone (nearly £478 million) represents the cost of a fleet consisting of 5 battleships, 4 aircraft-carriers, 45 cruisers, 300 destroyers, 160 corvettes, 33 submarines, 267 minesweepers, 124 motor-torpedo boats, 117 depot ships, sloops, monitors, etc.

Over £5,000 million had been saved or lent free of interest to the nation up to March, 1943. That is an average of over £100 per head of the British population. —"What Britain has Done"—Ministry of Information. Q 2070.

7. BRITISH AGRICULTURE IN WAR TIME.

British farmers are doing a vital war-job in cutting down the import of food and relieving the strain on shipping to the utmost by bringing back land to cultivation and improving the fertility and output of the land by the best possible methods of draining and mechanized farming.

The ploughing-up campaign in 1942 has brought 6 million more acres under the plough than before the war: this means three acres under the plough for every two before. That was previously considered to be about the maximum possible achievement, but still more acres are being ploughed in 1943.

From being 40 per cent self-sufficient in food before the war, Britain has now made herself nearly 70 per cent self-sufficient. This is an achievement unsurpassed in agriculture.

The British output of wheat, barley and oats had risen in 1941, measured by tonnage produced, by 50 per cent since the start of the war. British vegetable production was raised form 2½ million tons in 1938 to nearly 4 million tons in 1941.

In 1942 something like 80 million tons of crops were harvested. Allotments now stand at practically double the pre-war figure; there are over 1,750,000.

Between 2 and 3 million private garden owners contribute to the war effort producing £10–115 million worth of vegetables, thus releasing land for crops which private individuals cannot grow.

Britain now grows her own domestic sugar ration from beet.

In the first six months of 1942 British milk production was 10 million gallons above the pre-war average for the first six months of the year; this despite the great increase in ploughland.

The increase in total sales of milk in England and Wales for the six months ending September 1942, as compared with 1941, was over 40 million gallons.

About four million acres have been or are being improved under the drainage programme. In the first nine months of the wartime drainage programme, the British had already achieved more than the Italians in their much-vaunted drainage of the Pontine marches which took considerably over nine years.

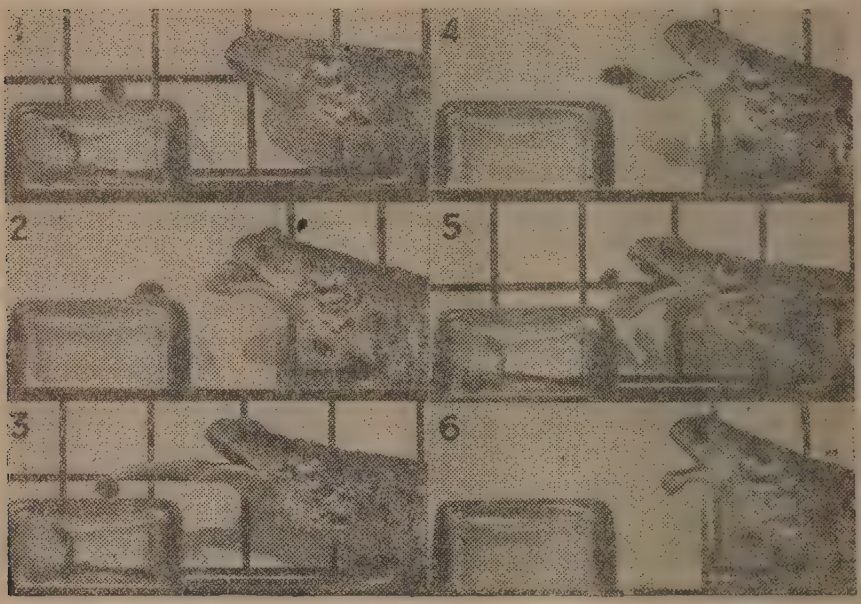
Britain is to-day the most highly mechanized farming country in Europe. She is estimated unofficially to have 125,000 tractors, as against 50,000 at the start of war. Therefore Britain now has more tractors than the Germans, who had 70,000 at the start of war. Output per man in Britain, measured by food values, has gone up by 66 per cent as compared with a mere 5 per cent in Germany. British agriculture is now producing per man unit nearly three times as much as the Germans.

Even on the land Britain, in the autumn of 1942, was able to maintain a 24 hours-a-day effort, thinks to the introduction of night ploughing. Day and night the ploughmen toiled, the unskilled workers being trained for daytime ploughing, and the skilled ones working through the night.

—Ministry of Information,Q2070.

8. WOOD LICE CAUGHT BY TOAD'S TONGUE.

The accompanying six photographs, taken by Dr. O. R. Barclay of the Zoology Department, Cambridge, show the common toad sticking out its tongue and demonstrate some interesting features of the mechanism of this movement. The tongue is fastened to the front of the mouth instead of to the back, as ours is, and is hinged in front. The surface which lies upwards when the tongue is at rest becomes the lower surface when the tongue is extended, this surface is sticky, and small prey are captured by it if they



are fairly dry. When the tongue is pulled in, the reversal of the surfaces can be seen from the rotation of the prey through 180°. Prey are only taken if they are moving and distance is judged by binocular vision.

A number of modern text-books assume that protrusion is accomplished by a sudden increase of pressure of the lymphatic fluid but since it can be performed in less than one-twentieth of a second and there are no signs of inflation of the tongue, this seems unlikely. Gaupp describes, in the frog, a muscular mechanism which might be adequate, but only partial protrusion can be obtained by electrical stimulation in a pithed specimen. A possible explanation may be found in the following facts.

When the mouth is shut the tongue does not apparently lie flat down the throat, but is advanced to lock into a groove in the upper jaw close to the internal nasal openings. This may serve to hold the jaw tightly shut, and to remove the tongue from over the top of the windpipe, which is constantly moving in respiration; also the internal nasal openings are probably closed

by the tongue when required, and this may be the main function of the tongue apart from feeding. This advancing of the tongue when the mouth is closed must be accomplished by the basal muscles that Gaupp thinks are responsible for sticking it out. Before the tongue is extended they are probably relaxed and by a very rapid contraction, simultaneous to the opening of the mouth, the tongue is shot out, the tip following the base by momentum. These muscles, therefore, probably contract in two ways, ordinary stimulation only eliciting a slower contraction.

Monthly Science News, No. 19, February, 1943.

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9. THE HARVEST IS—LIBERTY.

By
L. F. EASTERBROOK.

JULY the Fourth as Britain's first Farm Sunday, is a new festival in her country calendar. The people of Britain's towns and villages set that day aside to ask God's blessing for the coming harvest and dedicate themselves to the tremendous task of gathering the crops. For the farmers have grown more than they can possibly hope to harvest without the aid of volunteers from the towns. Half a million volunteers have been asked for, and that call will be splendidly answered.

Farm Sunday then is a day of thanksgiving and resolve, based upon solid achievement. For the nation and the experts have been equally astonished at what the farmers have accomplished. With less land available for farming than before the war, and with a slight reduction in the number of regular male farm workers, Britain looks forward to-day to what may well prove the greatest harvest in her history, greater even than last year, when her pre-war output of food was increased by 70 per cent, measured in calories.

SACRIFICE AND NEW EFFORT.

Tens of thousand of acres of land have been reclaimed, despite the wartime shortage of labour and materials. But the land reclaimed does not equal the amount of land that has had to be taken from agriculture for military and industrial purposes. In a comparatively small country this sacrifice of land to airfields, military training grounds and factory sites cannot be over-emphasized.

Agriculture has had to make another sacrifice, so important that there were those who prophesied at the beginning of the war that it would mean her output of food must fall instead of rise. It has been the imported feeding stuffs, on which a large part of Britain's livestock industry was built up. They were the raw material, processed on the farm into milk, meat, eggs, butter and cheese. The pre-war imports ran at the level of about 8½ million tons. To-day they are just over one million tons and are represented almost entirely by by-products, e.g. wheat offal and oilcake from crushed oil seeds. These imports were cut down, of course, to save shipping.

So Britain's farmers not only had to grow more crops for direct human consumption, but more crops to feed their animals. They have done so to such good effect that the cattle population, which stood at an all time record in the year war broke out, has maintained its high level. The beef cattle

are slightly less, but the increase in dairy cattle more than outweighs this loss. Sheep, at the top of a high curve in 1939, have fallen by number 20 per cent; there has been a reduction in the head of poultry, though the decrease of 24 per cent on the farms is tempered a little by a big increase in the number of hens kept by householders and fed on scraps. Pigs have suffered the most heavily. Their pre-war numbers have been halved.

Double Wheat and Potato Crop.

Arable land has been increased by over 50 per cent. The potato acreage this year will be double the pre-war figure, and the wheat acreage very nearly double. The area under oats, sufficient to supply over 90 per cent of Britain's requirements before the war, has been raised by over 70 per cent, chiefly to make up for lost imports of other feeding stuffs.

The acreage under vegetables is more than half as much again, and in addition to this there has been a tremendous increase in the vegetables private householders are growing for themselves, either in their private gardens or in plots (known as " allotments ") that they hire for themselves Allotments had risen in 1942 from the pre-war figure of 930,000 to about 1,750,000 and there has been a further increase since then. A rough estimate of the number of private gardens cultivated for vegetables suggests that they have increased from 3 to 5 million.

In any circumstances these would have been remarkable achievements in three years, especially when it is remembered into what a bad state world conditions had plunged British agriculture. When the labour situation is taken into account as well, the results are even more striking. There are less men working regularly on the farms. Their places have been taken by volunteers of the Women's Land Army (nearly 53,000 strong at the beginning of this year, now over 65,000) none of whom had previous experience of farming. More casual workers and a certain number of Italian prisoners have given further aid.

Seven Million Acres of Grassland Ploughed.

The change-over from a system of predominantly grass, or pastoral, farming to a system of intensive arable farming normally demands not only considerably more labour, but more skilled and experienced labour. About 7 million acres of Britain's grassland have been ploughed up and so more skill has been required to manage the acres of grass that are left. Yet milk sales have been breaking all records.

So it is with some feeling of pride that the people of Britain chose to celebrate Farm Sunday. But not just to congratulate themselves. The morning to Religious observances, processions and meetings in the towns, both large and small on such a day give the people chances to give their thanks for the past while planning for the future. The townsfolk are told what the farmers have accomplished and how their aid is absolutely essential if this great harvest is to be safely gathered in.

The ships saved by the efforts of Britain's farmers and people brought the munitions from overseas just tipping the balance. They enabled the fort to be held while Britain gathered strnegth and fresh Allies came to join her. In this sense it would be true to say that the British harvest is also a contribution to liberty; and once the freedom of the world hung on Britain could keep up her food supplies.

—Ministry of Information, Q2857

REVIEWS.

1. FARMER ARMY TRIUMPHS ON FOOD FRONT.

By
JOHN BARRY, B.A.

A grim battle is being fought in Britain to-day. It is the Battle of the Farmers, the Battle for Food.

Britain is regarded by the United Nations, and rightly so, as the great base from which the Western offensive will be launched against Hitler. But it is often forgotten what an unceasing struggle is needed to keep this base itself in existence. Britain would starve, the base would collapse, if the U-boat campaign were to succeed in the Atlantic.

This fight against the U-boat by Britain's Navy and merchant fleet must go on ruthlessly, unceasingly, regardless of cost. And it is in this grim battle that the farmers of Britain to-day are playing a magnificent role. Every extra ton of grain, of animal feeding stuffs, of vegetables they can produce, saves shipping space, saves ships—and so helps to preserve the base for the Western offensive.

Britain's G.H.Q. in this battle for food is the Ministry of Agricultur. But the real executive points, corresponding to the field H.Q's in battle are the War Agricultural Executive Committees. There is a separate War Agricultural Committee for each county in England.

Orders come down from the Ministry of Agriculture, but their execution depends on the County War Agricultural Committees. These Committees control the supplies of state-owned tractors that can be thrown in this or that part of the battle-front. Through these Committees work the Agricultural Research Council, the Scientific Advisory Committee, the Agricultural Improvement Council and all the other scientific bodies on which the nation's leading agricultural scientists are gathered.

In the development of intensive farming, England has led the world since the 18th century. The result is that to-day, the average yield per acre of wheat in England is 32 bushels—easily the highest in the world.

Some figures on the achievements of the Battle of the Farm Front in Britain, the battle to hold the fortress, may be interesting.

Before the war, Britain was producing only one-third of her food; the rest was imported from overseas. To-day, thanks to the heroic achievements of the farm front, she is producing two-thirds of her food requirements. Before the war there were 12 million acres of land under the plough in Britain. The total area of Britain is 55 million acres. In other words, 22 per cent of the land area was under the plough before the war. To-day, 18 million acres, 33 per cent of the entire land area of the country, is under the plough.

To-day, Britain is self-sufficient in potato production—the increase in potato production has been over 60 per cent since the outbreak of the war. Britain has increased her vegetable production over 80 per cent. Wheat production has increased by 40 per cent, oats by 60 or 70 per cent. In spite of the huge increase in land under the plough, and so a decrease in grazing land, milk production in the first six months of 1942 was actually 10 million gallons higher than the average production in the first six months of the three years before the war. This magnificent result on the milk front has been due partly to the great war of the farmers against waste, their salvage efficiency. Every scrap of agricultural by-products—straw, sugar-beat tops, etc.—has been used for animal fodder.

Town Growers Help Too.

The industrial workers and town-dwellers have also played a big part on the food front, through their allotement gardens. The number of allotments has practically doubled since the outbreak of the war to a figure of $1\frac{3}{4}$ million. In addition, there are between 2 and 3 million household gardens. Most of these private gardens used to be flower gardens around the houses, and have now been converted to the growing of vegetables. The total production of these household gardens and allotments now amounts to between £10 and £15 millions' worth of vegetables per annum, thus releasing more agricultural land for grain crops.

2,300 co-operative pig clubs have grown up throughout the country since the outbreak of war. These clubs are run by people working in factories, in offices and transport, that is, non-farming people. Yet in 1941 they produced 7,000 tons of bacon for the national larder—i.e. one hundred million breakfasts of two rashers per person.

So the grim battle of the farm front goes on in Britain. The battle for the preservation of the island base from which the Western offensive will be launched against Hitler. The battle of the Farm Front will be won!

—Ministry of Information, P9969.

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2. REPORT ON LAND UTILIZATION IN RURAL AREAS IN U. K.

The improvement of rural housing is an essential prerequisite of a contented countryside. The number of rural houses fit for habitation is totally inadequate and a big building programme should be undertaken after the war.

Women should be appointed members of all Housing Committees of local authorities.

Rural housing designs should be subject to approval for plan and elevations as well as for materials. All agricultural buildings should be brought under planning control.

Electricity should be made available throughout the country at no higher price to the consumer than in the town. We do not anticipate that any increased burden will result for the town.

Review of the whole position of water supply from the national point of view with special reference to the following matters amongst others is necessary:—

(*a*) the provision of a main supply to all towns and larger villages not at present supplied;

(*b*) the reorganization of supply areas;

(*c*) the use of gathering grounds for additional purposes, e.g. hill sheep farming, afforestation, recreation.

All water supply undertakings should be brought under national planning control.

Every village should be provided with adequate playing fields and the advice of the National Playing Fields Association sought.

There should be an extension of afforestation on poor land together with the establishment of forester's part-time holdings and national forest parks. The Forestry Commission should be empowered to enforce the proper management of all woodland in the country. More attention should be paid to the planting of trees and shrubs in the design and lay-out of housing development.

There must be facility of access for all to the countryside but this must not interfere with the proper use of land in the national interest. The Central Planning Authority, in conjunction with the appropriate Scientific Societies, should delimit nature reserves, and take the necessary steps for reservation and control.

Holiday camps should be provided, subject to planning control of siting and design.

Legislation should be passed imposing an obligation on all those who derive benefit from the working of land for minerals to restore that land for agriculture or afforestation or other purposes within a short specified period of time after the land has been worked out.

Seasonal or part time employment for agricultural workers and their families should be provided if possible.

Agricultural, soil, and land classification surveys should be made round each expanding urban area with the object of directing housing and other construction towards less productive land and of preventing the disruption of farm units.

All new villages and country towns should be situated away from main traffic roads though within easy access to them and all existing villages and country towns which have main traffic roads running through them should be by-passed as far as possible.

Civil aerodromes should form a part of local planning schemes and their siting and building should be controlled; it is hoped that it will not be necessary to withdraw first class farm land for this purpose.

All land should be planned both nationally and locally. The power of compulsory acquisition of agricultural land by the State should be exercised where required in the interests of national planning or of providing agricultural efficiency.—*Report of the Committee on Land Utilization in Rural areas* 1952 (Cmd. 6378). —H.W.J.

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3. REPORT OF THE SUGAR COMMISSION FIJI.

THE Report of the Commission recently appointed by the Governor to inquire into the demands of the cane growers for an increase in the price of cane and matters incidental thereto, has recently been published, and the salient points are herewith summarized and should prove interesting to readers.

The demands of the cane farmers for an increase in the price of cane were formulated on the following grounds:—

1. Increase in the cost of living during the war.
2. Increase in the cost of production of sugar cane during the war.
3. Decrease in production of cane, and consequently decrease in receipts, due to lack of artificial fertilizers.
4. Loss incurred by the farmers in 1941 owing to non-payment of preference bonus on one-third of the crop.

For the average small sugarcane farmer, who operates approximately 12 acres of land and annually harvests three acres of plant canes and three acres of ratoon canes giving an aggregate harvest of 123 tons of cane, the weighted general cost of living since 1939 was found to have increased by 66 per cent or £29 14s. 3d. The increases were food 66·5 per cent, fuel and cleaning materials 43·8 per cent, clothing 127·7 per cent, and other expenditure 136·5 per cent.

The cost of production of the average annual crop was found to have increased by £14 9s. 0d. or 33 per cent compared with 1939. These increased costs include the cane cutting bonus paid to substitute cutters and now reckoned at £10. This is only paid by about half the farmers and is not recognized by the Colonial Sugar Refining Company so that those farmers who join the cane cutting gangs themselves are better off to the extent of £10.

The following table gives a summary of the annual position of costs and returns in 1939 and in 1943:—

	1939.	1943.
Cost of Production	£43 15 7½	£58 4 7½
Cost of Living	44 9 4	74 3 7½
Total ..	£88 4 11½	£132 8 3
Return on 123 tons cane .	92 5 0	129 3 0
Return on Rice	6 0 0	10 0 0
Total ..	£98 5 0	£139 3 0
Surplus ..	£10 0 0½	£6 14 9

This table shows that while the farmer had a surplus of £10 in 1939, he now has £6 14s. 9d. so that the measure of his hardship due to the war may be taken as £3 5s. 3d. The prices received by farmers for their cane increased from 15 shillings per ton in 1939 to 21 shillings at present, or 40 per cent; while the increase in cost of production of cane is given as 33 per cent.

While a decrease in production of cane due to lack of fertilizers is likely in time to have some effect, so far, however, no significant effect could be shown and evidence indicated that better cultivation could largely counteract the lack of fertilizers.

The year 1941 was unfortunate for sugar growers in that shipping difficulties restricted exports to two-thirds of normal production which resulted in a substantial loss to producers which may be assessed as a war loss.

The sugar content of the cane in 1942 was low so that the deferred payment based on sugar content was only 5d. per ton compared with 25d. in 1940. While this difference caused dissatisfaction, the prices paid were in accordance with the cane purchase agreement which is generally well understood by the growers.

As bonuses are not necessarily designed to cover the whole of any increases in costs which have taken place during the war, the Commission decided that no further increase in the price of sugar cane was justified at present.

—H.W.J.

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4. RESTARTING AGRICULTURE IN DEVASTATED EUROPE.

Sir John Russell, Director of Rothamsted Agricultural Station, England, gives an interesting summary of the post-war needs of agriculture in Europe, pointing out that a state of starvation exists amongst all victim peoples. Deficiency diseases are rampant and with shattered resistance such diseases as tuberculosis, typhus, malaria, etc., are destroying vast numbers, but worse still whole populations, crushed and made listless with hunger, are rapidly sinking to a condition where they can no longer take much part in rebuilding their shattered lives.

The material means of recovery have suffered appalling destruction. Agriculture is largely thrown out of gear and systems of farming and rotations are upset while transport—the twin sister of agriculture, is utterly disorganized. While steps will be taken to send supplies of food to Europe as a first measure it is imperative that agriculture in Europe should be restarted at the earliest opportunity.

The first essential need will be for food yielding high calorie returns such as potatoes and cereals. Pulses will be almost as urgently needed to take the place of meat which will be very scarce for years. For these crops, tractors will have to be shipped from U.S.A.; seed must be supplied suitable to different climates and soils. The bare minimum grain and potato seed requirements are 500,000 tons and 425,000 tons respectively, though ten times these quantities would be needed to fill demand. The accumulation and shipping of such quantities presents many difficulties.

The rehabilitation of live stock will present much greater difficulties since up to the middle of 1942 at least 11,000,000 cattle, so vital as sources of meat, milk and motive power on the farm, were known to be destroyed. The consequent fall in milk yield has been estimated at 35 per cent or 3,500 million gallons in a year. Similarly, the destruction of pigs, the chief source of animal fats, amounted to 12 millions, of sheep 11 millions, of horses 4 millions, and poultry as much as 75 per cent of the total population. As a year has elapsed since these figures were calculated the position now must be very much worse.

Restoration of animal population will be slow and laborious and cannot be attempted until suitable food is in sight and this need in itself presents a tremendous problem. Immediate increase of the animals in Europe can only come from overseas. For this purpose the enormous transport difficulties can be envisaged when it is stated that one ordinary cargo boat of 7,000 tons or so could only accommodate about 700 head of cattle so that for cattle only more than 1,400 journeys would be needed to transport the one million cattle necessary to serve as a basis for rebuilding herds to normal sizes again in the course of about six years. The restoration of horses would take twice as long and present even greater difficulties.

It is estimated that the sheep population would take nine years to replace. Pigs and poultry could be replaced more quickly than other animals provided that sufficient food was available but as they require much the same foods as are sorely needed for the human population, it will not be practicable to encourage their production until the human food position has been considerably improved.

The reduction of livestock has greatly decreased the production of farm yard manure and this has been intensified by the shortage of phosphates so that production of food and fodder crops is heavily handicapped.

Lastly, there remains the vast problem of resettling on the land more than 12 millions of people said to have been taken or deported from occupied territories. This problem Sir John wisely avoids owing to its immensity.

He discussed the merits of large and small scale farming in the reconstruction of Europe and states that, in general the small farms are best for gross production but the large farms for net production. In the occupied territories, however, representations clearly indicate that they do not want large farms and as there are big peasant populations imbued with real land hunger, it seems certain that small farms will predominate.

For the successful establishment of peasant holdings the author expresses the firm opinion that the only hope lies in the development of strong co-operative movements such as have been so beneficial in Denmark. He also stresses the great need of education, especially moral education which teaches a man to pull his weight and play the game in his community.

—H.W.J.

—*Nature*, No. 3833, 17th April, 1943.

5. GRASS AS A SOIL PROTECTOR IN WEST AFRICA.

In a report circulated by the Imperial Bureau of Pastures and Forage Crops an interesting account of the functions of grass in the economy of the Northern Territories of the Gold Coast is given by the Senior Agricultural Superintendent.

The native people are cattle owners and carry on a primitive form of subsistence agriculture, shifting their cultivations after three or four years cropping. Under these conditions abandoned lands revert quickly to grass and bush and recover their fertility. The cattle population is limited by lack of water supplies and of dry weather grazing, so that in the wet season the growth of grasses cannot be controlled by grazing. Grass burning is practised to keep the country "open." Early burning is encouraged to reduce damage to trees and to leave as much litter as possible for soil protection. On naturally more fertile lands a more "fixed" type of farming is carried on, including the use of farmyard manure. The level of manuring is, however, not sufficiently high to maintain fertility indefinitely and after several generations the land has to be abandoned. Such land has usually become so worked out, eroded and denuded of its natural vegetal cover that recovery of fertility is almost impossible so long as annual burning is permitted.

The alleviation of these conditions is being sought through the control of bush and grass burning, which is largely an administrative problem affecting the whole community and immediate in its effect, and through the introduction of "mixed farming"—which is used here to mean the manufacture and use of farmyard manure—which is capable only of comparatively slow extension from individual to individual.

Throughout the report the author emphasizes that the soil and water conservation value of the grass cover is of the most immediate importance; the utilisation of grass as fodder is a matter for later and necessarily much slower development.

Results from trials and observations are given. These show that: (1) after ten years protection from fire the land does not become choked with undecayed matter and there is an appreciable improvement in ground cover and stock-carrying capacity; (2) hay made from bush grasses, together with the scant grazing, will carry stock through the dry season; (3) bush grasses provide, as litter, an excellent basis for farmyard manure which, even in dressings of only four tons to the acre, will greatly enhance yields, thus providing an alternative to shifting cultivation; (4) if 25 per cent of the land could be manured annually instead of only 12 per cent as at present, permanent farming on the more fertile lands could be put on a sound basis and eventual abandonment of the land rendered unnecessary; (5) contrary to the expectations of pessimists, the Native Administrations have been able successfully to apply regulations prohibiting grass burning in inhabited areas and requiring early burning in the surrounding uninhabited "bush."

—C.H.

—Lynn, C. W. 1943—Report circulated 20th May.

6. U. K. LONG TERM AGRICULTURAL POLICY.

MEASURES of permanent policy should be introduced as soon as possible, and the Government's interim arrangements for guaranteed prices and assured markets should be extended until those measures begin to operate.

The fundamental purposes of long term policy should be the proper use and management of the agricultural land of this country for the production of the foodstuffs which it is best fitted to provide and which are most required to satisfy nutritional needs while maintaining the fertility of the soil, the raising of the standards of rural life and the increase in the rural population.

Guaranteed prices and regulated markets for such foodstuffs should be assured. Control of imports should be exercised.

The improvement of internal marketing processes should be actively pursued through the medium of marketing boards with regulatory functions. Methods of distribution should be thoroughly overhauled with a view to providing standardized products for the towns at the minimum cost and with the maximum speed between the farm and the consumer.

Production policy should be primarily devoted to the expansion and increased efficiency of the livestock and livestock products and the horticultural industries, these being the main sources of farming income and of the better nutrition of our people.

Ley farming should also be vigorously developed, with a view to establishing a system of alternate husbandry or mixed farming based upon livestock.

A farming system based on ley husbandry and livestock production would make essential active measures to combat animal disease; to improve the general practice of livestock breeding and selection; to provide water and fencing; to integrate more fully the administration of land drainage and to provide for the extension of drainage and ditching and the proper maintenance of existing works; to prevent the impoverishment of dairying land; to assure adequate supplies of home-grown protein feed; and to ensure satisfactory standards in respect of cultivations by contractors.

The needs of the small or family farmer should be given close attention, with particular reference to the development of pig and poultry keeping and horticultural production; and special measures should be taken to improve the health and quality of our poultry flocks.

The expansion of the output of horticultural crops should be encouraged, and the marketing sytem improved.

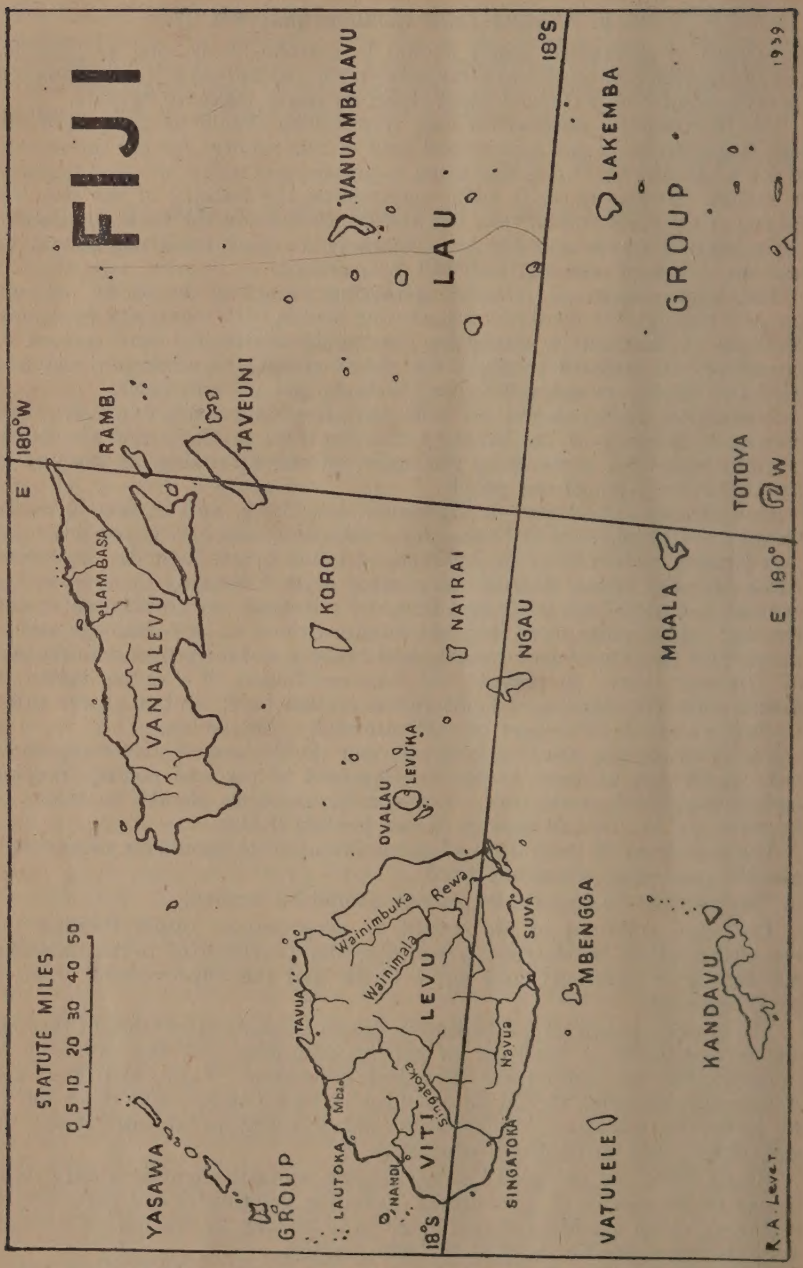
The interests of cereal cash growers should be secured.

The rural standard of life should be progressively raised through the establishment of satisfactory wage-rates, the provision of better housing, the supply of electricity and piped water, and the improvement of other rural amenities.

The system of agricultural education should be made more efficient through the improvement of facilities for general education and the extension of opportunities for subsequent technical education. Farm institutes and demonstration farms should be provided in each County, and there should be improved provision for bursaries and scholarships at institutions for agricultural and horticultural education.

Means should be provided for encouraging eminent scientific ability to be drawn to the service of agricultural (including veterinary) and horticultural research; closer attention should be given to making the findings of research workers more speedily applied to farm practice.

Report on the Principles and Objectives of Long Term Agricultural Policy. Council of Agriculture for England, H. M. Stationery Office, 1943. —H.W.J.



So as to include Kadavu and Totoya within the framework available the map has been rotated some 6° to the east.

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—R.J.A.W.L.

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